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ERTS Image Analysis: Preliminary Report #1
January 1973

ID # 1099-10104, Orbit 1098
Date of Acquisition, 22 Sept. 1972
Site: Inland Delta of Niger River
Republic of Mali
West Africa

Disciplines: Geology, Agriculture, Hydrology, Ecology

Geology: Lineaments; four orientations of Lineaments are seen, expressed by the courses of the Niger and Bani Rivers, the boundaries, external and internal, of the Inland Delta marsh areas, sand fields in the Delta -- coincident with the Bani River course in one section, and in the apparent sand-filled wind-eroded lineaments of the highland east of the Delta (north-east corner of image). The orientations are similar or the same as those seen in Apollo 9 photos (March 1969) and follow trends which are now apparent in Nimbus III HRIR processed images, trends which involve the entire Delta. Lithographic units may become apparent in future analysis but are not seen by us so far.

The major geologic information concerns lineations related to surface expression of fractures or faults not previously recognized. This information is particularly useful in hypotheses now being conceived concerning ground water relationships -- see below (Hydrology).

Agriculture: To date our analysis has located a small area of irrigated cropland, east of Segou and south of Kara. There may be further agricultural settlement information such as that observed in ERTS imagery of Angola, Kenya, and Tanzania. Our study of vegetation distribution is incomplete and may reveal further direct agricultural information.

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(E73-10047) ERTS IMAGE ANALYSIS. INLAND DELTA OF NIGER RIVER, REPUBLIC OF MALI, WEST AFRICA Preliminary Report (American Univ.) 4 p HC \$3.00 CSCL 08H

Hydrology: The crest of the annual Niger River flood was in the southern portion of the Inland Delta at the time this image was acquired. This means that a map of high water in this part of the Delta can be produced. We will use two approaches; first, manual linedrawings on overlays, and second, a planimetric analysis using density slicing techniques on the Spatial Data System equipment.

The braided pattern of the Niger River course, old channels not water-filled even at this time of high waters, lakes, marshes and several degrees of inundation are all features discernable in the image. The Bani River does not appear to have a braided stream pattern. Given the very slight hydraulic gradient of the Niger, 40 meters in 1,000 kilometers of river distance or .004%, one would expect to see meanders in the main river course. Instead, the river follows lineations coincident in orientation with those seen away from the river. The apparent dry course between the Niger and the Bani Rivers (previously unmapped) does show meanders and meander scars. This course appears to be filled with sand. Its history and significance in relation to the Niger and Bani Rivers are unknown.

The hypothesis mentioned in the Geology section concerns the possibility of locating ground water adjacent to the Inland Delta. We (Konate and MacLeod) used additional information about the Niger River flood -- namely, that in years of below mean annual precipitation, the river flow into the Inland Delta is less than average -- as expected, but the outflow from the Delta is greater than expected using a forecast based on precipitation in the western river course. The hypothesis is that this additional flow into the Delta is from fractures in the adjacent savannah. This flow must be from sources near the surface

(as it is noticed as a surface phenomenon), and as there are about three months for the additional flow to appear, the water must flow, not through porous media, but through near-surface channels. The fracture system seen in the imagery could be such near-surface channels. Water would flow, subsurface, into the land surface adjacent to the Delta during the flood and out of the surface after a lag period -- much like a six-month periodic tide. The area into which water might flow is most particularly the very flat savannah, west of the Delta. Using the ERTS image as a guide, we are identifying lineaments into which shallow wells might be drilled or even dug, to test the hypothesis. Should the idea be confirmed by drilling, there is a good possibility that much more extensive grazing and cropping could be supported by the establishment of tube well stock watering sites and other simple water supply systems for utilizing the annual "tide". One might also expect to find substantial aquifers by the same methods, though this search would entail more elaborate and expensive drilling.

Hydrology Summary:

1. River courses and Inland Delta boundaries appear controlled by surface expression of fractures or faulting.
2. High water maps of southern Inland Delta, marshes and lakes can and will be done.
3. Easily tested hypothesis concerning prospecting for extensive ground water in savannah region is postulated.

Ecology: Ecological relationships of plant communities can be mapped from this image, but species information -- and therefore detailed ecological analysis -- must await field studies. About 10 types of wetlands are easily discerned, but their separation and specific identity remain to be determined.

Obviously desertification has penetrated into specific areas in the East, the West and South of the Inland Delta. The sand areas will be mapped, first by hand, then with other techniques. Location of vegetated areas outside the Delta will also be undertaken. Direct soils information may be extracted in the future but there is no pattern (spectral or spatial) that appears at this time.